

Risk Management at NASA and Its Applicability to the Oil & Gas Industry

OPERATIONAL EXCELLENCE IN OIL AND GAS

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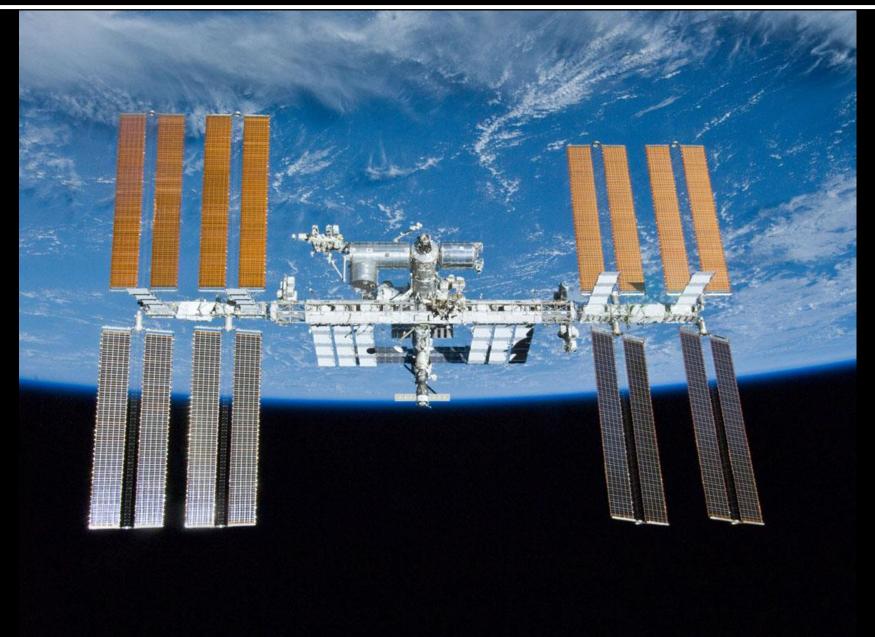






- 1. Why is NASA's experience relevant to offshore oil and gas?
- 2. What is Probabilistic Risk Assessment (PRA)?
- 3. What is the relationship between NASA and BSEE Headquarters?
- 4. What is NASA presently doing with Anadarko Petroleum Corporation and with Shell International Exploration and Production?





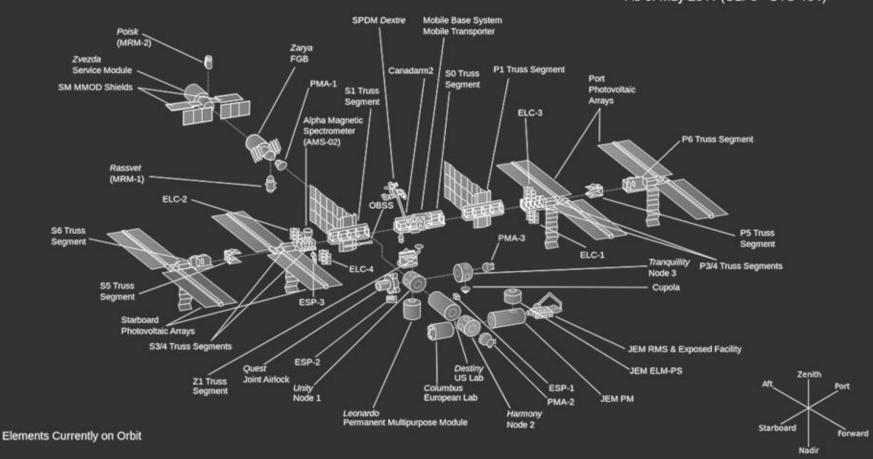






ISS Configuration

As of May 2011 (ULF6 - STS-134)







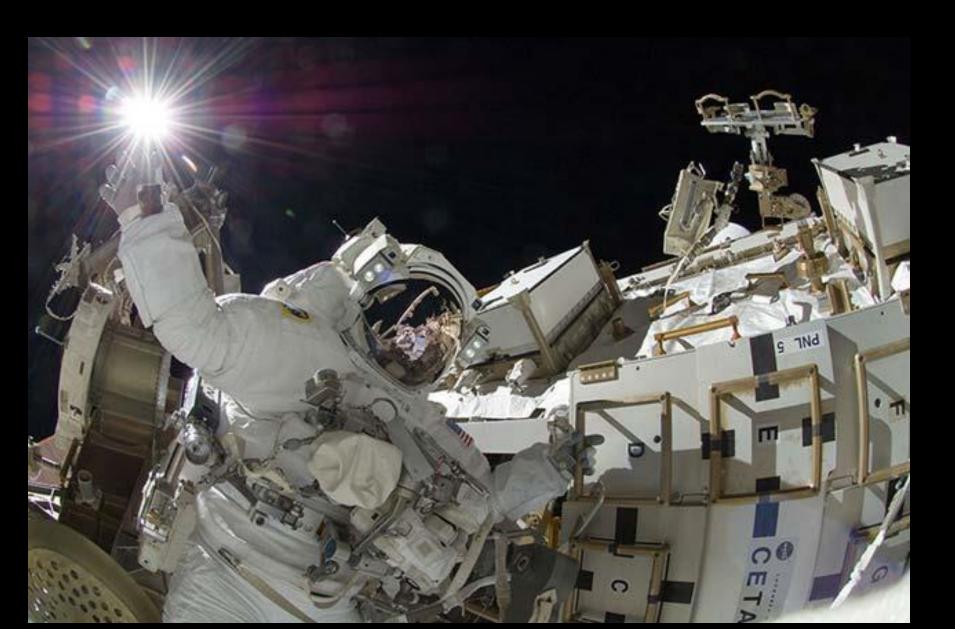
Complex Operations Dependent on Human Involvement





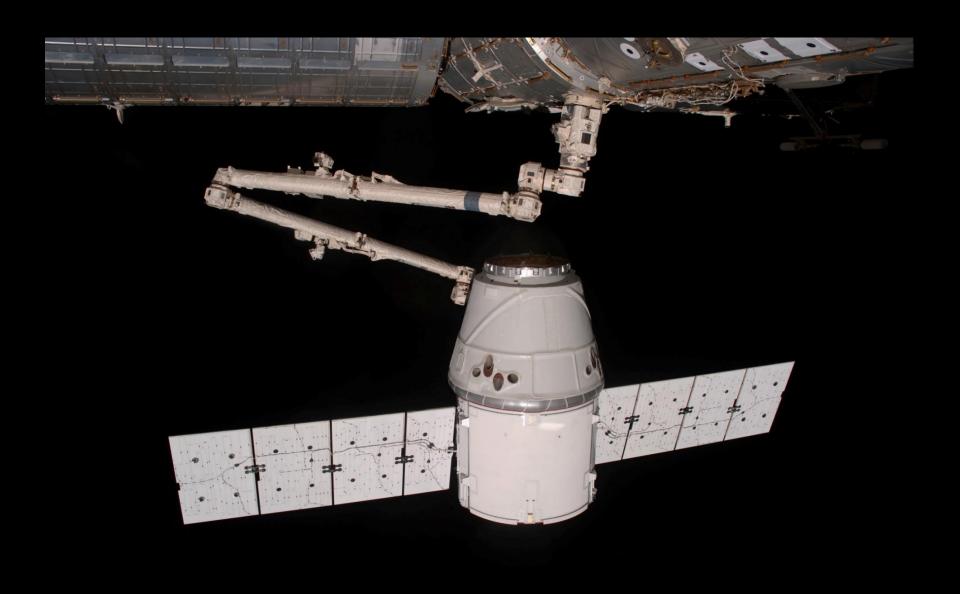
Repair and Maintenance Operations in a Hostile Environment





Ongoing Resupply Operations





ISS Mission Control Center





Isolated and Not Easily Accessible







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Qualitative versus Quantitative Risk Assessment



QUALITATIVE risk assessment is commonly based on experience or expertise and results in categorical estimates of risk.

QUANTITATIVE risk assessment leverages empirical data to determine and assign numerical values to risk.

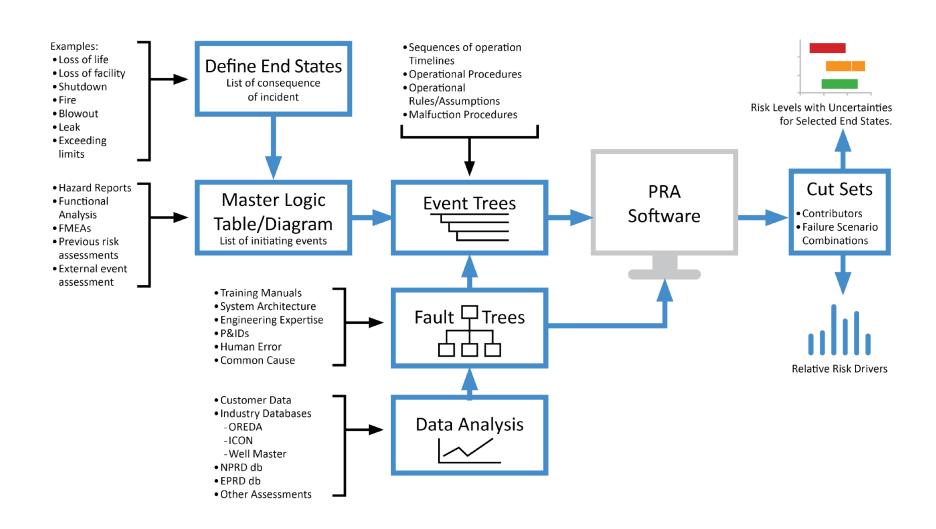
First, Define the "End States" of the PRA Analysis





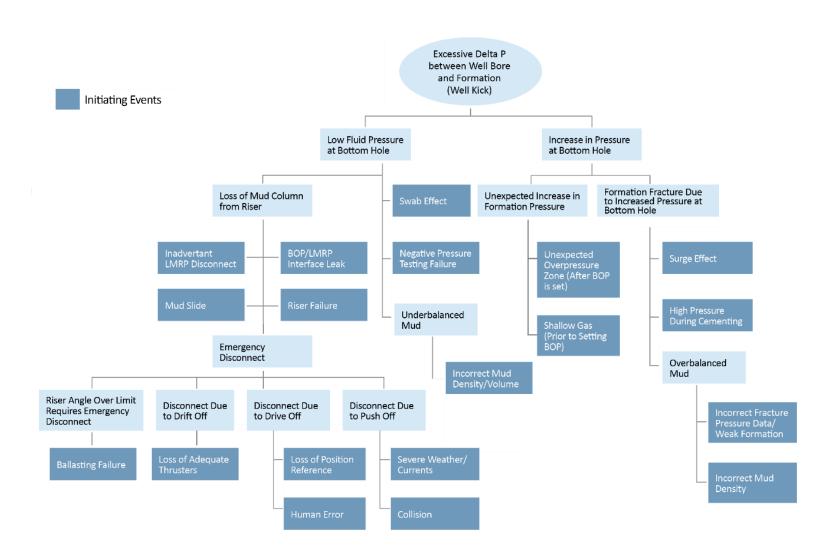
Major Steps to Perform a PRA





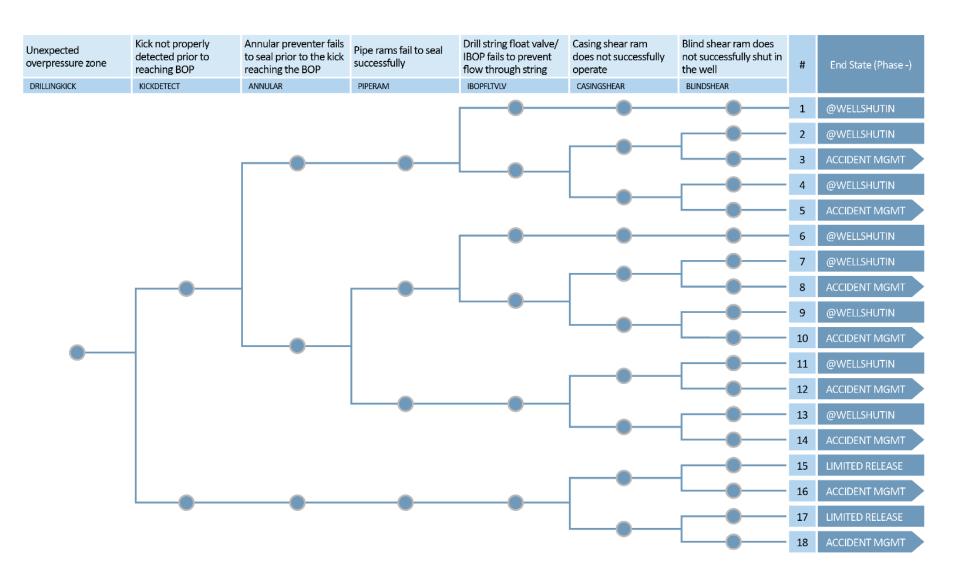
Notional Master Logic Diagram for a Well Kick While Drilling





Example Event Tree for Response to an Unexpected Overpressure Zone While Drilling

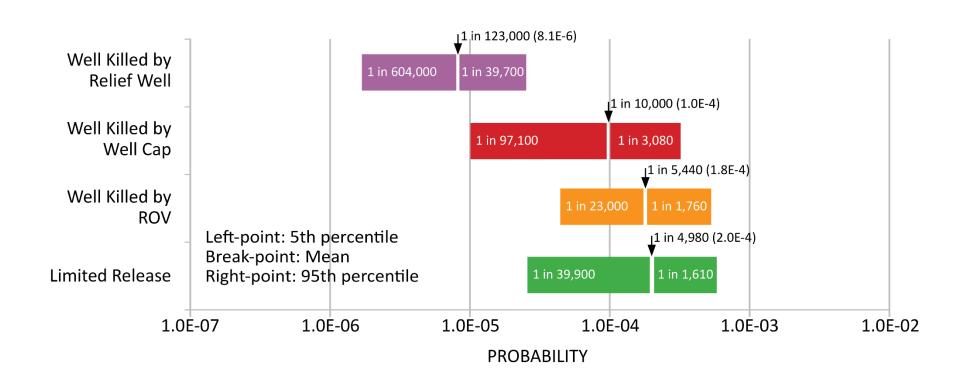




Notional Example of End State Probabilities with Uncertainty



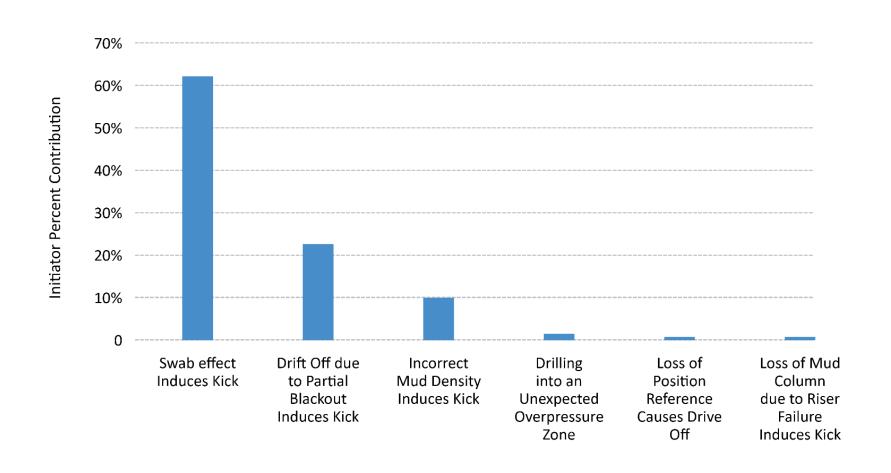
Highest Probability



Lowest Probability

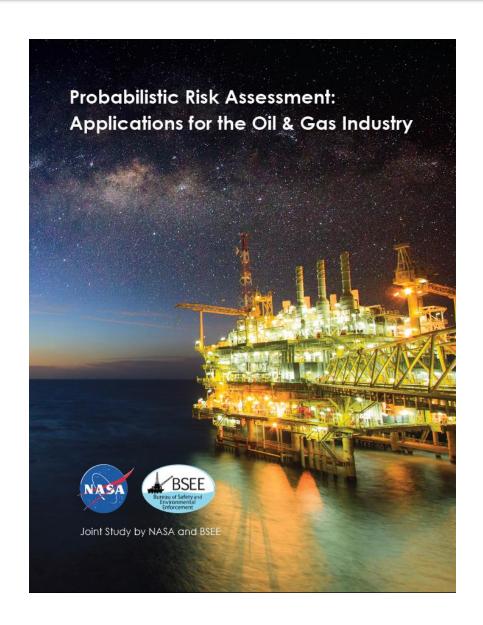
Notional Initiating Event Ranking Leading to a Well Kick





Data in this figure does not represent any particular facility. Rankings may be different for slightly different designs or operational procedures/practices.







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U.S. Bureau of Safety and Environmental Enforcement



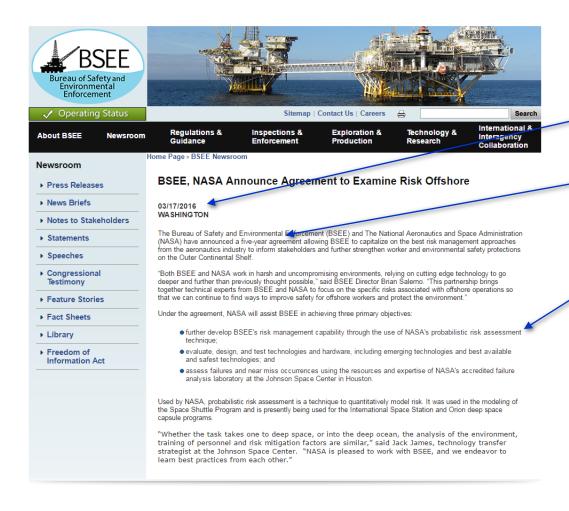


Mission Statement: The Bureau of Safety and Environmental Enforcement (BSEE) works to promote safety, protect the environment, and conserve resources offshore through vigorous regulatory oversight and enforcement.

U.S. Bureau of Safety and Environmental Enforcement



NASA – BSEE Interagency Agreement



March 17, 2016

5 Year Agreement

NASA's probabilistic risk assessment technique

NASA Tasks for 2017



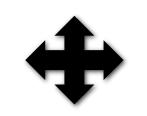
PRA Procedures Guide for Offshore Applications (DRAFT)

https://www.bsee.gov/what-we-do/offshore-regulatory-programs/risk-assessment-analysis/probabilistic-risk-assessment-analysis



Deep water Drilling PRA







PRA Data Needs



Subsea Production Hardware PRA



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Generic 20,000 psi Blowout Preventer (BOP) Model

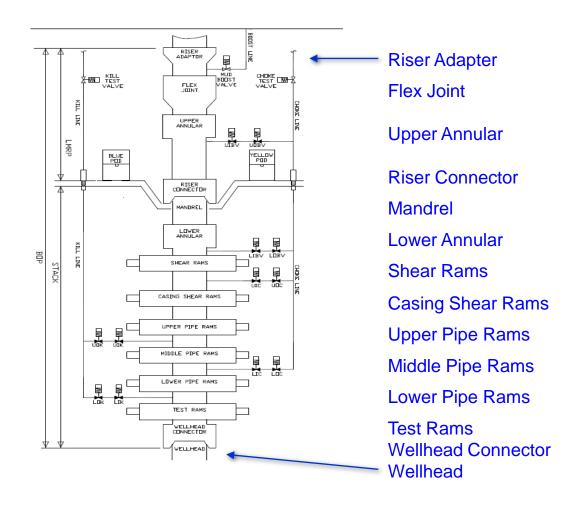


End State:

Loss of Containment

Initiating Events:

- Well Kick Occurs
- Loss of Position



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Key Insights from Generic Blowout Preventer (BOP) Model



"Well Kick" Initiating Event:

→ Human Error Dominates over Failure of Equipment

"Loss Of Position" Initiating Event:

→ Failure of Blind Shear Ram and Shuttle Valves were Important Contributors

Data used in this study are generic in nature. The current model results are viewed as preliminary at this time.



Dynamic Positioning System (DPS) Model





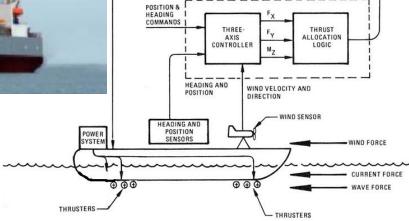
Class 3 Drilling Vessel

End State: Loss of Location

Initiating Events:

THRUSTER COMMANDS

- Drift-off
- Drive-off
- Push-off



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Next Activities with Anadarko Petroleum Corporation



Expand the PRA Model to Include:

- BOP Surface Control Systems & Control System Sensors
- Emergency Disconnect Sequence
- Dead Man & Auto-Shear Sequences
- Hydraulic Lines and MUX Cables
- Mud System Sensors, Mud Logger Sensors;
 Driller Shack Sensors
- Tool Pusher Monitoring; Company Man Monitoring; Real Time Shore-Based Monitoring







Shell – NASA Space Act Agreement "Kick-Off" Meeting: July 6, 2017

New Well Control Rule from BSEE [30 CFR 250.734 (a)(3)] will require additional subsea accumulator volume for hydraulic fluids.



